

*Observations on the Astronomical points determined by the brothers Schlagintweit in Central Asia.\*—By Captain GOLUBIEF.*

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During the current year, the first volume of the Narrative of the Scientific Expedition of the brothers Schlagintweit to India and High-Asia, extending over a period of four years, from 1854 to 1858, has made its appearance. This remarkable production is all the more valuable, inasmuch as it will not only embrace the results of the explorations of the brothers Schlagintweit, but likewise those of many learned travellers who were their predecessors in this field of inquiry. The first volume contains a collected series of astronomical and magnetic determinations. The number of the points for which geographical co-ordinates are given is 112, but the degree of their exactness differs considerably. Many of the points for which co-ordinates are given were obtained from Indian triangulations; but many others were determined from march-routes alone. The determinations which are less exact, belong naturally to the northern portion of the journey, to Tibet and Turkestan. The corrections which it would be necessary to make in the existing maps, in consequence of the Schlagintweits' determinations, would be very considerable, particularly in longitudes. Thus, for instance, Lé, in Ladak, is alleged to lie 44' more to the West than was originally supposed, and altogether the whole of western Tibet would have to be removed about 20' to the westward. The changes in the latitudes are less extensive, the highest do not exceed 10', as in the case of Balti. The Karakoram pass, the highest point attained by Europeans who had preceded the Schlagintweits, lies more northwards by 11', and the same distance farther to the West than marked on any previous map.

\* This paper was read at a general meeting of both sections of the Russian Geographical Society. The president of the section of physical geography, M. Semënof, who had only just returned from abroad, took occasion to express his own doubts as to the correctness of some of the determinations and conclusions of the brothers Schlagintweit. He communicated to the members present that these results, which bear evident traces of haste, are regarded with equal doubt by the learned in Germany. The extensive range of the labours, the multiplicity of the collections and observations which devolved on the celebrated travellers, produced the confusion and irregularity apparent in their observations and collections.

The weight which is to be attached to these corrections, must depend on the degree of exactness which regulates the scientific labours of the brothers Schlagintweit; but unfortunately, in the volume that has been issued, this consideration is not dwelt on, that is to say, the probability of errors in the determinations is nowhere alluded to. The determinations themselves are not particularised minutely enough, to enable us to estimate their value.

In order to judge of the correctness of these labours, we bring forward some examples. Thus, in the determinations of Lé in Ladak, the error which should be expected in the latitude would amount to 30". The longitude of Lé was determined by the transfer of one chronometer which was rated at Simla on the 15th May, at Lé on the 17th September, at Srinagar the 24th October; the longitudes of Simla and Srinagar are known. The rate of the chronometer should have been deduced from the longest transfer occupying 162 days, from which, in the main result, a considerable error was to be expected† amounting to no less than 7'.5. Further an error has crept into the calculations of the brothers Schlagintweit which, when corrected, will alter their result by 8' (instead of 77° 14' 6" it should be 77° 22' 5" east of Greenwich). The correction of the chronometer was determined on the Karakoram pass on the 9th of August; by its action from Simla (15th May) to Srinagar (24th October) the longitude of the pass was determined at 77° 30' 4". But corrections of the chronometer at Lé were also obtained on the 11th July and 17th September, according to which the determinations of the Karakoram pass is found to be 77° 39' 5" or, otherwise, differing by 9'.

\* The latitude of Lé was determined twice by polar heights.

11th July, . . . . .	34° 7'5
16th September, . . . . .	34° 9'2

Mean, . . . . .	34° 8'3
According to Cunningham, . . . . .	34° 9'1
Moorecroft, . . . . .	34° 9'3

† The chronometer was rated in the Observatory of Calcutta in March, 1855 and April, 1857 (pp. 98 and 102). From this it must appear, that the probable 24 hourly disturbance of the chronometer on the spot would not be less than ±s. In the longitude of Lé, also, one can suspect an error of at least  $\frac{\pm s. 125.37}{162} = \pm 29s$ . From Simla to Lé is a journey of 125 days, from Lé to Srinagar 37 days; whole duration of the journey 162 days.

But the Schlagintweits express their doubts as to the correctness of the determination of time at Lé on the 11th July, and, therefore, do not take it into account. Nevertheless, an error of no less than 10' must, in all probability, be suspected in the longitude of the Karakoram pass as well as in the longitude of Lé. It remains, consequently, open to doubt, which longitude is to be accepted, that given by the Schlagintweits, or that previously adopted by Humboldt, which Thompson, who visited this pass in 1848, found to be quite accurate. Up to this point, the corrections are less than  $\frac{1}{2}^{\circ}$ , and applied to the map attached to the description of their journey, they excite curiosity, but not surprise; but the upper portion of the map representing Central Asia puzzles every one, by its marked difference to every thing that has hitherto been known of these countries. It is sufficient to say that the position of the three bases of the cartography of this part of Asia, namely the towns of Khotan, Yarkand and Kashgar, disagrees with those hitherto generally accepted, by nearly 180 versts, for all the three points nearly equally lie 10' in latitude, and 130' in longitude, more southward and westward, according to the dictum of the Schlagintweits.

At the same time, the determinations of little Bokhara, which belong to the Jesuits, cannot call forth strong doubts; on the contrary, there is strong reason for believing, that if these determinations are not altogether correct, they are but very slightly incorrect. In Djungaria, there are several points determined by the Jesuits, and some subsequently by me in 1859. From a comparison of these determinations, it becomes evident that the latitudes given by the Jesuits are correct to a minute. But the astronomical observations in Djungaria were, in all probability, not made by the Jesuits themselves, but by Chinese whom they had instructed. It must therefore be supposed, that the points in little Bokhara, where the Jesuit fathers worked themselves, are equally correct. As regards the longitudes, it is well known that the existing itineraries coincide perfectly well with the determinations of the Jesuits, though it must be acknowledged that the marche-routes having almost a meridional direction, cannot point out any appreciable error in the longitudes. Generally speaking, the better acquainted we become with Chinese Turkestan, the more convinced we are of the accuracy of the determinations of the Jesuits.

In support of this, we shall here bring forward the following example. There are two routes, besides others, across the Tian Shan leading to little Bokhara; one from Kuldja to Aksu, the other from the southern shore of Lake Issyk-kul by way of the Faükù pass, to Ush. Until the astronomical labours of 1859, both these routes presented on the map considerable angles with the axis of the mountain range; the first one of nearly  $45^{\circ}$ , and the other that of  $30^{\circ}$ , but according to the astronomical results obtained in 1859, it was found that the inclination of routes from Kuldja to Aksu, to the axis of the range, did not exceed  $30^{\circ}$ , while the route to Ush intersects the ridge in a direct line, and runs north and south. It appears strange then after this, if, seeing the great inclination of the transverse routes to the axis of the mountains, that Issyk-kul, with the neighbouring countries on the northern side of the Tian Shan, had not been before removed to the west, as was done subsequently in consequence of the astronomical determinations; or that all the series of points in Little Bokhara were not removed to the east, and in every case not to the west. Facts like these, speak in favour of the positions of Ush and Asku, and other towns of Little Bokhara determined by the Jesuits; and it must be observed, that up to the present time no one has had the same means, as possessed by them, of determining the relative positions of these towns. The last point that the Schlagintweits determined instrumentally, is Suget, a halting place for caravans, proceeding from Ladak to Yarkand. This route is marked on a very rare map, which is a direct copy of an original one compiled by the Jesuits and translated by Klaproth; a point on this road under the same latitude with Suget, as determined by the Schlagintweits, has nearly one and the same longitude. Beyond Suget, all the other points on the Kuen-lun and in Turkestan, are determined by the marche-routes; the most northern of these and nearest to Khotan, which the two brothers Herman and Robert succeeded in reaching, is the village of Bashia. This point is also given on the map of the Jesuits, its position being fixed by marche-routes, not by direct determination. The difference in the positions of Bashia, as given by the Jesuits and the brothers Schlagintweit, amounts to  $6'$  in latitude, and  $47'$  in longitude. How is it then possible, after this, to accept the position of Khotan, and with it that of the other towns of Turkestan, as given by the Schlagintweits,

differing as it does by 130' in longitude from the astronomical determinations of the Jesuits, when neither Herman nor Robert visited Khotan, while the papers of Adolph perished with him in Kashgar?

But how are we to regard the more recent labours in the country adjoining Little Bokhara, which cannot be reconciled to the points of the Schlagintweits?

Thus Sarry-Kul, the source of the Amu, which was determined by Wood, the Schlagintweits could not place on their map, according to the determination of Wood, but were obliged to remove it nearly 2° to the westward.

Issyk-kul is also marked on the map 2° more to the west than it should be, according to the last Russian astronomical determinations in 1859. And if this Lake be marked in its true position on the map of the Schlagintweits, Sarry-kul would then fall back on Yarkand, and the western extremity of Issyk-kul will appear above Asku, which, of course, would be impossible.

Petermann, in his notice of the labours and researches of the Schlagintweits, is of opinion that a review of their determinations in Little Bokhara is premature, more especially as the marche-routes by which they were guided, are not yet published. But the astronomical results of 1859, which so distinctly contradict the determinations of the Schlagintweits, belong to the Russian Geographical Society, and this is our excuse for expressing our doubts of the correctness of a certain portion of the results of the brothers Schlagintweit, before receiving the data on which they are based.

